HALF-LIVES

Purpose:

This lesson will point out that radioactive materials become less radioactive over time through the process of radioactive decay. Additionally, students will learn that the time for radioactive materials to lose essentially all their radioactivity can vary from seconds to thousands of years and that the half-life of a radioisotope is the time it takes for a quantity of that radioisotope to lose half of its radioactivity. The necessity for providing safe disposal for materials with high specific activities as well as those containing radioisotopes with very long half-lives will be discussed.

Concepts:

1. Radioactive materials become less radioactive over time through the process of radioactive decay.
2. The time for radioactive materials to lose essentially all their radioactivity can vary from seconds to thousands of years.
3. Radioactive materials with the highest activities per unit weight decay the fastest.
4. Each radioactive isotope has its own distinct half-life.

Duration of Lesson:

One 50-minute class period

Objectives:

As a result of participation in the lesson *Half-lives*, the learner will be able to:

1. complete a chart on half-lives of significant radioisotopes;
2. differentiate which three radioisotopes have the highest and lowest specific activity; and
3. explain the significance of the information on the half-life chart as it relates to permanently disposing of radioactive waste.

Skills:

Analyzing, calculating, critical thinking, drawing conclusions, evaluating, filling in a chart, interpreting

Vocabulary:

Fission, spent fuel, transuranic

Materials:

Activity Sheets

Half-lives, p. 107

Background Notes

Half-life Measurements, p. 27

Suggested Procedure:

1. If you have not already done so in Unit 1, read and discuss the reading entitled *Nuclear Waste: What Is It? Where Is It?* A question/answer type study guide has been supplied to facilitate class discussion.
2. Have students fill in the chart and answer the questions on the activity entitled *Half-lives*. Discuss the activity as a group.

Sample Discussion Questions:

1. Is it possible to predict when a radioactive isotope will decay and produce radiation?

   (Radioactive isotopes decay at random, and it is impossible to predict which one will decay next. However, when these atoms are gathered together it is possible to see a pattern. This pattern is described by use of the term half-life.)
2. What is half-life?

   (The amount of time it takes for a quantity of a given isotope to lose half of its radioactivity is known as half-life.)
3. Discuss the meaning of the term "decay chain."

   (This is the ordered process that certain elements pass through in order to become stable. For instance, the isotope uranium-238 transforms into many different isotopes before it becomes stable lead. Some isotopes may change in the next second, some in the next hour, some tomorrow, and some next year; others will not decay for thousands of years. Half-lives range from fractions of a second to several billion years.)

Teacher Evaluation of Learner Performance:

Student response during discussion and on activity sheets will indicate level of comprehension.

Enrichment:

Using Half-Lives, p. 133